Non-Interferometric Optical Active Emission Object Detection and Tracking Mechanism

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Introduction

The practice of using roving LiDAR emission platforms in orbit in order to detect previously unknown satellites leaves much to be desired in terms of the response time in which an orbital platform may respond to a suspected hostile launch. Once a reconnaissance drone detects a platform, a second "tagging" drone must be dispatched in order to "Lo-Jack" the hostile satellite in order to enable its tracking regardless of any potential orbital adjustment.

Even once a satellite is tagged, these tags can fail, can be jammed or removed by the owner of the satellite, et cetera. In order to emplace tags on newly orbited platforms as rapidly as possible, ideal points of intercept must be calculated in advance (given the tortoise speed of space-based drones.)

A ground-based detection system of a novel variety could prove highly effective in correlating SBIRS launch detection events with the detection of the satellites themselves in orbit just minutes later.

Abstract

Atmospheric scattering has, for the history of attempts to use optics to send signals from the surface of the Earth to satellites and back again (for either communication or reconnaissance,) frustrated these efforts. While helical light has recently been established as a superior approach to overcoming this problem, an alternative approach to orbital object detection (from the ground) lies in the use of clusters of three high-powered LASER beams of uniform polarity in which each of these three beams differs in polarity from the others by 120 degrees of angle.

If one wished to detect an object in orbit without relying upon interferometry, one might emit these near-parallel beams toward various points in orbit and use what might be termed a central geodesic detector capable of capturing reflected light from various directions and measuring distortions to the polarity of the light which can be used to guide the operation of the emitter clusters, which would be strategically distributed on a global scale and disguised as benign astronomical tools.

An exact three-dimensional positional fix could be obtained for a "bogey" orbital object by first sweeping the sky until a detection event is registered by the geodesic detector, which would be emplaced on a mountaintop for maximal effectiveness in capturing reflected light from orbit. Depending upon which of

the three polarities are detected, the search area could be narrowed and the emitter cluster(s) could be reoriented until they achieve a two-dimensional lock. Once this is achieved, the point of convergence of the three beams could be adjusted in order to find the altitude of the orbiting object. The interaction of the three beams with one another would create a predictable skew in the polarity of all three beams. The presence of this skew would indicate that the detected object is above the currently calibrated point of convergence.

This point of convergence would be adjusted to an increasingly distant point from the emitter until this skew ceases to be detected by the geodesic detector. If the point of convergence exceeds the satellite being detected, the central detector would abruptly cease to detect any reflected light, indicating to the painting emitter that it should move the beams closer together. Beams from multiple points on the surface of the Earth could be used to further reduce the margin of error of the positional estimate.

Importantly, this system enables the detection and real-time, location-specific tracking of objects in orbit from the ground without reliance upon interferometry, which is limited in its effective range by atmospheric scattering. Although the atmosphere would, indeed, unpredictably alter the polarity of light reflected from a satellite in this scheme, the use of three beams with 120 degree-offset polarity would ensure that all three beams, given that they follow the same path through the atmosphere at the same time, would experience the same distortion. This ensures that the detector may detect the unique conjunction of a bright burst of three polarity-uniformed pulses in unison which are 120 degrees offset from one another; useful for detection for the reason that this combination is unlikely to occur naturally.

Conclusion

In addition to enabling the rapid tagging of enemy satellites, this system could be used to inform emergency trajectory changes for friendly platforms in order to avoid collisions with natural and man-made objects.

A minimum of three detector stations would be required as well as a minimum of several dozen emitter clusters around the world. The cost, although substantial, would be well worth the investment given the benefits. The system could be constructed using existing technologies, meaning that little investment in engineering would be required in order to enable the system.